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CARCASS CHARACTERISTICS OF BROILER RABBIT FED ON SWEET POTATO BASED RATION

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ABSTRACT

The present investigation was carried out to study the carcass characteristics and growth performance of two breeds of rabbits New Zealand White (NZW) and Soviet Chinchilla (SC) raised on rations containing various levels of sweet potato (Ipomoea batatas) as an energy source. Five groups of weaned NZW and five groups of weaned SC rabbits, six in each group were fed five isonitrogenous concentrate mixtures containing 0,10,20,30 and 40 percent boiled sweet potato replacing equivalent amount of maize grain for a period of 45 days. Sweet potato feeding influenced the carcass characteristics and body composition of experimental rabbit. The live weight before and after fasting was significantly (P<0.01) higher in Ration 2, 3 and 4 group, but there was no significant difference in shrinkage percentage due to incorporation of sweet potato in the diets. The percent yield of various edible offal, dressing percentage, percent yield of various wholesale cuts, significantly differed, however weight of total inedible offal were not significantly (P<0.05) influenced by dietary variations. Except the percentage of moisture, that of crude protein, crude fat and ash values were not influenced by the inclusion of sweet potato tuber in rations, however there were breed differences in all the above traits. The incorporation of sweet potato in rations significantly (P<0.01) affected the final body weight of both breed of rabbits.

KEYWORDS: Rabbit, Sweet Potato, Carcass Characteristics & Body Composition

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Original Article

INTRODUCTION

There has been rising global awareness on the virtues of rabbit meat production in developing countries like India as an alternative means of alleviating food shortages. Rabbit farming although a new venture in India, but it is gaining popularity because of its tremendous scope; which grow rapidly and their growth rate is comparable to that of broiler chicken (Rao *et al*., 1977). This small animal can turn 20 per cent of protein they eat into edible meat under uniform managemental condition, while for chicken, pig and beef cattle these values are 22 to 23, 16 to 18 and 8 to 10 percent, respectively. Maize is one of the most important cereals used in the animal feed. The annual production is 10.5 million tons (in 1999-2000 AD) and its approximate usage is 4.5 million tons in animal feed industry. The maize production in India is almost static. About 3,00,000 MT of maize was imported in to India during April 1999 to March 2000 (Vaidya, 2000), indicating an acute shortage of maize grain in the country. Rabbits can be raised on high roughage diets or diets without grain which have also comparative advantage over poultry and swine (Kalita, 1998).

MATERIALS AND METHODS

The experiment was conducted with thirty weaned New Zealand White (NZ) and thirty weaned Soviet Chinchilla (SC) rabbits (average 42 days old) and were divided into five groups of six animals each as uniformly as possible with regard to body weight at the Rabbit Research Farm under Animal Production Division of ICAR Research Complex for NEH Region, Umium, Meghalaya. The ICAR Rabbit Research Farm is located at an altitude of 980 m above mean sea level and lying between 25°30′ N and 91°51′ E. The feeding trial was conducted for 45 days. The experimental rabbits were reared under uniform managemental conditions by housing them individually in clean metallic cages, fitted with feeders and waterers and kept inside a well ventilated cement floored shed. The experiment was conducted in 2 way interaction design (Snedecor and Cochran, 1995). In order to explore carcass characteristics of broiler rabbit, preparing them after weaning period and make recommendations for suitable substitute fed on sweet potato in place of maize in rabbit feed, this study is being taken up in broiler rabbits.

Five isonitrogenous concentrate mixtures with CP 16% and TDN 70% (Ration 1, 2, 3, 4 and 5) were prepared out of which the control concentrate mixture (Ration 1) was prepared with conventional feed ingredients (Maize, Wheat bran, Deoiled rice bran, Soya bean meal, Ground nut cake, Rice husk, Fish meal, Mineral mixture, Common salt) and the experimental concentrate mixtures Ration 2, 3, 4 and 5 were also prepared with the conventional feed ingredients where maize was replaced by sweet potato @ 25, 50, 75 and 100 per cent level (w/w), respectively.

Carcass Characteristics

To study the carcass traits three rabbits from each group of experimental animals were slaughtered as per Arrington and Kelly (1976) method. Before slaughtering rabbits were kept on overnight fasting, however, clean drinking water was provided to them. To make the animal unconscious, before slaughter, the head was bent backward with a hard sharp pull to dislocate the neck. Immediately after stunning the blood vessels were severed with a sharp knife just backside of the lower jaw and the carcass was hung upside down to facilitate bleeding. The fur skin was cut around hock joints of the legs and gradually across the lower part of the body. The skin was then free to be pulled down and forward over the body. De-skinning was done carefully to avoid any wear and tear of skin, which might reduce the price of the skin. After removing the head and forefeet a cut was made on the skin at the lower part of abdomen to remove gastro-intestinal tract, genitalia, kidney etc. A straight cut was made at chest cavity to remove different edible and non-edible offal like heart, liver, lung, spleen etc. The weight of the hot carcass was taken to find out the dressing percentage. The eviscerated carcass was washed with clean water and then cut into different wholesale cuts like leg, loin, rib and fore shank. The following records were maintained for the study of carcass traits, i.e. (i) Live weight of animal before fasting, (ii) Live weight of animal after fasting, (iii) hot carcass weight, (iv) weight of pelt, blood, head etc. (v) weight of non-edible offal including fore feet, hind feet, tail etc. (vi) weight of edible offal i.e. liver, heart, kidney etc. (vii) weight of different wholesale cuts. Then all the weights were expressed in percent of slaughter weight.

Carcass Composition

To find out the major proximate composition meat sample were collected from *longissimus dorsi* muscle. Then (i) moisture, (ii) crude protein, (iii) Crude fat and (iv) ash content were analysed as per A.O.A.C. (1980) method and the results were expressed as percent weight.

RESULTS AND DISCUSSIONS

Carcass Characteristics

Mean values of various carcass characteristics of the experimental rabbits from different groups slaughtered at the end of the feeding trial have been summarized and statistical analysis presented in Table 1. Live weight before and after fasting shown highly significant (P<0.01) difference due to different experimental rations. The significant (P<0.05) difference among the breed × ration in respect of live weight before fasting was recorded. However, there was no significant difference due to breed in all the above mentioned traits. Shrinkage percent also did not show any significant difference due to ration, breed and ration × breed. The live weight before fasting was highest in Ration 3 (1548.33 ± 2.799) followed by Ration 2 (1541.67 ± 4.22 g), Ration 4 (1535.83 ± 2.01 g), Ration 1 (1526.67 ± 2.79 g) and Ration 5 (1519.17 ± 3.27 g), respectively. The same trend was also followed in live weight after fasting; where in Ration 3 (1507.50 ± 3.10 g) it was highest and lowest in Ration 5 (1483.33 ± 3.57 g). The range of percent shrinkage was 2.64 ± 0.10 to 2.18 ± 0.07.

Hot carcass weight and dressing percentage differed significantly (P<0.01) among the rations. There was also significant (P<0.05) interaction between ration × breed in respect of dressing percentage. The weight of hot carcass was observed highest in Ration 3 (779.00 ± 2.84 g) followed by Ration 2 (773.33 ± 2.25 g), Ration 4 (769.00 ± 2.77 g), Ration 1 (760.00 ± 1.57 g) and Ration 5 (754.17 ± 1.25 g), respectively and also in respect of dressing percentage it was highest in Ration 3 (51.67 ± 0.22) and lowest in Ration 5 (50.85 ± 0.19). No significant difference was observed among the ration × breed in respect of percent head weight. However, there was significant difference (P<0.05) between the breed and rations in respect of percent head weight. The percent head weight was significantly (P<0.05) higher in NZ breed (10.02 ± 0.04) than the SC breed (9.86 ± 0.04) and in respect of ration, there was no significant difference among the Ration 2 (10.00 ± 0.05), Ration 3 (10.00 ± 0.05) and

Table 1: The Mean ± S.E. Values of Different Traits of Carcass Characteristics of Rabbits

Attribute	Ration					Overall (Breed)
	1	2	3	4	5	
I	II	III	IV	V	VI	VII
Live Weight before Fasting (g) :						
NZ	1526.667^{a} ±6.007	1548.333^{b} ±6.014	1543.333^{bc} ±3.329	1535.000^{ac} ±2.901	1525.000^{a} ±2.901	1535.667 ±2.960
SC	1526.667^{a} ±1.658	1535.000^{a} ±2.901	1535.333^{b} ±1.658	1536.667^{a} ±3.329	1513.333^{c} ±3.329	1533.000 ±3.644
Overall (Ration)	1526.667^{a} ±2.787	1541.667^{bc} ±4.219	1548.333^{b} ±2.793	1535.833^{c} ±2.008	1519.167^{a} ±3.271	1534.333 ±2.319
Live Weight after Fasting (g) :						
NZ	1491.667 ±6.014	1508.333 ±6.014	1501.667 ±1.683	1501.667 ±1.683	1488.333 ±6.014	1498.333 ±2.655
SC	1495.000 ±2.901	1501.667 ±1.683	1513.333 ±3.329	1501.667 ±4.416	1478.333 ±1.683	1498.000 ±3.266
Overall (Ration)	1493.333^{a} ±3.071	1505.000^{b} ±3.167	1507.500^{b} ±3.098	1501.667^{b} ±2.113	1483.333^{c} ±3.573	1498.167 ±2.068
Percent Shrinkage :						
NZ	2.293 ±0.009	2.580 ±0.185	2.700 ±0.100	2.170 ±0.105	2.403 ±0.222	2.429 ±0.075
SC	2.077 ±0.112	2.170 ±0.105	2.573 ±0.185	2.280 ±0.188	2.313 ±0.185	2.283 ±0.075
Overall (Ration)	2.185 ±0.070	2.375 ±0.132	2.637 ±0.098	2.225 ±0.099	2.358 ±0.131	2.356 ±0.054

Table 1: Contd.,						
Weight of Hot Carcass (g) :						
NZ	760.667 ±2.962	771.000 ±3.786	780.000 ±2.887	774.667 ±1.451	753.333 ±2.026	767.933 ±2.782
SC	759.333 ±1.762	775.667 ±2.332	778.000 ±5.568	763.333 ±2.026	755.000 ±1.732	766.267 ±2.681
Overall (Ration)	760.000^{a} ±1.571	773.333^{bc} ±2.254	779.000^{b} ±2.840	769.000^{c} ±2.769	754.167^{a} ±1.252	767.100 ±1.905
Dressing Percentage :						
NZ	50.993^{ac} ±0.016	50.913^{a} ±0.257	51.940^{b} ±0.244	51.590^{bc} ±0.061	50.620^{a} ±0.335	51.211 ±0.153
SC	50.793^{a} ±0.197	51.653^{b} ±0.205	51.407^{ab} ±0.347	50.833^{a} ±0.237	51.073^{ab} ±0.132	51.152 ±0.125
Overall (Ration)	50.893^{a} ±0.099	51.283^{ab} ±0.221	51.673^{b} ±0.224	51.212^{ab} ±0.202	50.847^{a} ±0.190	50.182 ±0.097
Percent Head Weight :						
NZ	9.787 ±0.099	10.100 ±0.068	10.167 ±0.088	10.077 ±0.039	9.987 ±0.013	10.023^{A} ±0.044
SC	9.767 ±0.052	9.903 ±0.033	10.043 ±0.043	9.943 ±0.030	9.650 ±0.041	9.861^{B} ±0.040
Overall (Ration)	9.777^{a} ±0.050	10.002^{b} ±0.055	10.105^{b} ±0.052	10.010^{b} ±0.037	9.818^{a} ±0.078	9.942 ±0.033
Percent Weight of Feet and Tail :						
NZ	3.030 ±0.061	2.850 ±0.076	2.977 ±0.062	2.887 ±0.055	3.020 ±0.081	2.953 ±0.032
SC	2.920 ±0.121	2.930 ±0.040	2.973 ±0.081	2.977 ±0.067	2.997 ±0.118	2.959 ±0.035
Overall (Ration)	2.975 ±0.065	2.890 ±0.042	2.975 ±0.045	2.932 ±0.044	3.008 ±0.064	2.956 ±0.023
Percent Blood Weight :						
NZ	3.127 ±0.286	2.983 ±0.333	3.327 ±0.188	3.107 ±0.288	3.133 ±0.222	3.135 ±0.106
SC	3.007 ±0.191	2.887 ±0.108	2.753 ±0.113	2.883 ±0.390	3.157 ±0.112	2.937 ±0.088
Overall (Ration)	3.067 ±0.156	2.935 ±0.158	3.040 ±0.161	2.995 ±0.222	3.145 ±0.111	3.036 ±0.070
Percent Pelt Weight :						
NZ	10.010^{ab} ±0.042	9.923^{a} ±0.029	10.077^{bc} ±0.039	10.080^{b} ±0.067	9.943^{ac} ±0.013	10.007 ±0.023
SC	10.103^{a} ±0.033	10.100^{a} ±0.051	9.930^{b} ±0.075	10.080^{a} ±0.049	10.073^{a} ±0.029	10.057 ±0.026
Overall (Ration)	10.057 ±0.032	10.012 ±0.047	10.003 ±0.050	10.080 ±0.037	10.008 ±0.032	10.032 ±0.018
Percent Weight of Full Stomach and Intestine :						
NZ	12.920 ±0.071	12.773 ±0.191	12.653 ±0.067	13.097 ±0.049	13.167 ±0.020	12.922 ±0.063
SC	13.000 ±0.052	12.767 ±0.058	12.820 ±0.021	13.007 ±0.133	13.187 ±0.090	12.956 ±0.050
Overall (Ration)	12.960^{a} ±0.043	12.770^{b} ±0.089	12.737^{b} ±0.049	13.052^{ac} ±0.066	13.177^{c} ±0.041	12.939 ±0.040
Percent Weight of Empty Stomach and Intestine :						
NZ	6.343 ±0.035	6.363 ±0.027	6.280 ±0.189	6.150 ±0.087	6.383 ±0.063	6.304 ±0.044
SC	6.173 ±0.122	6.390 ±0.098	6.167 ±0.069	6.303 ±0.052	6.403 ±0.130	6.287 ±0.046
Overall (Ration)	6.258 ±0.068	6.377 ±0.046	6.223 ±0.093	6.227 ±0.057	6.393 ±0.065	6.967 ±0.031

Table 1: Contd.,						
Percent Weight of Total Inedible Offal :						
NZ	23.203 ±0.339	22.807 ±0.427	23.317 ±0.108	22.883 ±0.184	23.173 ±0.348	23.077 ±0.126
SC	22.890 ±0.052	22.990 ±0.197	22.487 ±0.048	22.920 ±0.300	23.313 ±0.182	22.920 ±0.099
Overall (Ration)	23.047 ±0.168	22.898 ±0.214	22.902 ±0.193	22.902 ±0.158	23.243 ±0.178	22.998 ±0.080
Percent Weight of Heart :						
NZ	0.447 ±0.021	0.503 ±0.037	0.512 ±0.044	0.444 ±0.023	0.425 ±0.021	0.471^{A} ±0.016
SC	0.401 ±0.001	0.444 ±0.022	0.530 ±0.000	0.399 ±0.001	0.361 ±0.022	0.427^{B} ±0.016
Overall (Ration)	0.424^{a} ±0.014	0.487^{b} ±0.027	0.520^{b} ±0.020	0.422^{a} ±0.014	0.393^{a} ±0.020	0.449 ±0.012
Percent Weight of Liver :						
NZ	2.813^{ac} ±0.066	3.093^{b} ±0.067	3.020^{bd} ±0.020	2.907^{ad} ±0.056	2.777^{c} ±0.012	2.922^{A} ±0.037
SC	2.763^{ab} ±0.019	2.820^{b} ±0.020	3.107^{c} ±0.064	2.820^{b} ±0.026	2.727^{b} ±0.022	2.847^{B} ±0.038
Overall (Ration)	2.788^{ad} ±0.033	2.957^{b} ±0.069	3.063^{c} ±0.036	2.863^{a} ±0.034	2.752^{d} ±0.016	2.885 ±0.027
Percent Weight of Kidney :						
NZ	0.639 ±0.002	0.648 ±0.006	0.644 ±0.004	0.635 ±0.002	0.638 ±0.002	0.641 ±0.002
SC	0.640 ±0.005	0.635 ±0.002	0.645 ±0.002	0.637 ±0.001	0.638 ±0.002	0.639 ±0.001
Overall (Ration)	0.639 ±0.002	0.641 ±0.004	0.644 ±0.002	0.636 ±0.001	0.638 ±0.001	0.640 ±0.001
Wholesale Cuts : **Percent Weight of Legs :**						
NZ	37.247^{a} ±0.265	37.523^{a} ±0.531	37.860^{a} ±0.485	37.130^{a} ±0.119	35.130^{b} ±0.605	36.978 ±0.305
SC	35.683^{a} ±0.332	37.853^{b} ±0.280	38.090^{b} ±0.442	36.330^{a} ±0.174	35.937^{a} ±0.292	36.779 ±0.292
Overall (Ration)	36.465^{a} ±0.398	37.688^{b} ±0.278	37.975^{b} ±0.298	36.730^{a} ±0.202	35.533^{c} ±0.350	36.878 ±0.208
Percent Weight of Loin :						
NZ	28.177 ±0.227	27.970 ±0.221	27.567 ±0.218	28.273 ±0.127	28.453 ±0.295	28.088 ±0.117
SC	28.840 ±0.234	27.630 ±0.196	27.597 ±0.301	28.297 ±0.127	28.213 ±0.192	28.115 ±0.149
Overall (Ration)	28.508^{a} ±0.208	27.800^{b} ±0.153	27.582^{b} ±0.166	28.285^{a} ±0.081	28.333^{a} ±0.166	28.102 ±0.093
Percent Weight of Rib :						
NZ	18.797^{a} ±0.156	18.847^{a} ±0.274	19.230^{a} ±0.008	18.847^{a} ±0.190	19.953^{b} ±0.115	19.135 ±0.134
SC	19.137^{a} ±0.125	18.433^{b} ±0.306	18.507^{b} ±0.139	19.300^{ac} ±0.220	19.823^{c} ±0.146	19.040 ±0.158
Overall (Ration)	18.967^{ab} ±0.117	18.640^{b} ±0.206	18.868^{ad} ±0.173	19.073^{bd} ±0.165	19.888^{c} ±0.088	19.087 ±0.102
Percent Weight of front Shanks :						
NZ	15.773 ±0.112	15.650 ±0.193	15.343 ±0.267	15.747 ±0.130	16.460 ±0.247	15.975^{A} ±0.123
SC	16.330 ±0.219	16.070 ±0.132	15.807 ±0.222	16.070 ±0.149	16.023 ±0.139	16.060^{B} ±0.080
Overall (Ration)	16.052^{a} ±0.166	15.860^{ab} ±0.141	15.575^{b} ±0.187	15.908^{ab} ±0.114	16.242^{a} ±0.160	15.927 ±0.076

N.B. Sub-class averages with at least one superscripts in common (lower case along the row and upper case along the column) do not differ significantly. * P<0.05, ** P<0.01

Ration 4 (10.01 ± 0.04) groups and again in between Ration 1 (9.77 ± 0.05) and Ration 5 (9.82 ± 0.08) group.

The percent head weight was significantly (P<0.05) higher in NZ breed (10.02 ± 0.04) than the SC breed (9.86 ± 0.04) and in respect of ration, there was no significant difference among the Ration 2 (10.00 ± 0.05), Ration 3 (10.00 ± 0.05) and Ration 4 (10.01 ± 0.04) groups and again in between Ration 1 (9.77 ± 0.05) and Ration 5 (9.82 ± 0.08) group. There were no significant differences among the breeds, ration and ration × breed in respect of percent weight of feet and tail, blood, empty stomach and intestine of total inedible offal and kidney. However, significant differences were observed between the breed in respect of percent heart weight and liver weight. In respect of rations the range of per cent weight of feed and tail, blood, empty stomach and intestine, total inedible offal and kidney were 3.04 ± 0.06 to 2.89 ±0.04, 3.14 ± 0.11 to 2.93 ± 0.16, 6.39 ± 0.06 to 6.22 ± 0.09, 23.24 ± 0.18 to 22.90 ± 0.21 and 0.644 ± 0.002 to 0.636 ± 0.001, respectively. The per cent weight of heart and liver were significantly higher in NZ breed (0.471 ± 0.016 and 2.92 ± 0.427, respectively) than the SC breed (0.427 ± 0.06 (02.85 ± 0.04, respectively).

The significant differences were observed in respect of ration in per cent weight of full stomach and intestines, weight of heart and weight of liver, whereas, significant differences due to ration x breed was observed in per cent pelt weight and per cent weight of liver. The percent weight of full stomach and intestine was observed highest in Ration 5 (13.18 ± 0.04), followed by Ration 4 (13.05 ± 0.07), Ration 1 (12.96 ± 0.04), Ration 2 (12.77 ± 0.90) and Ration 3 (12.74 ± 0.05), respectively, whereas in respect of percent weight of heart highest percentage was recorded in Ration 3 (0.520 ± 0.020) followed by Ration 2 (0.487 ± 0.027), Ration 1 (0.424 ± 0.014), Ration 4 (0.422 ± 0.014) and Ration 5 (0.393 ± 0.020). The same trend was also followed in respect of percent weight of liver and was highest in Ration 3 (3.063 ± 0.036) and lowest in Ration 5 (2.752 ± 0.016).

Results related to various carcass characteristics attained in experimental rabbits slaughtered at the end of the feeding trial are discussed as follows:

Live weight before and after fasting differed significantly among the different rations, where before fasting live weight was significantly higher in Ration 2, 3 and 4 groups, but Ration 5 group was comparable with control group (Ration 1). The same trend was also observed in live weight after fasting. The significantly lower slaughter weight in Ration 5 and control (Ration 1) group might be due to the lower growth rate resulting in lower gain in body weight in respective stipulated period of feeding trial. Similar observation was reported by Abu *et al*. (1999) in rabbits fed diets containing sweet potato tops and dehydrated sweet potato root meal. Shrinkage percentage (fasting loss) did not differ significantly among the groups due to breed, ration and ration × breed. Kalita *et al*. (2000) also did not find any significant differences among the groups in respect of fasting loss (fasting shrinkage percent) due to different dietary levels of protein and energy. However, the shrinkage percentage was higher in the present findings and comparable with the values reported by Kumar (1995) and Saikia (1998).

Weight of hot carcass differed significantly due to rations (Table 1). Values were significantly higher in Ration 2, 3 and 4, but lower in Ration 5. Abu *et al.* (1999) observed similar trend in weight of hot carcass in rabbits where sweet potato roots were fed to them. However, Kalita *et al*. (2000) and Das *et al*. (2002) observed higher values and Gour *et al*. (1995) and Borthakur *et al*. (2003) observed lower values than the present findings. Dressing percentage differed

significantly due to ration and ration × breed. Dressing percentage obtained during the study were well within the range of reported values for NZW and SC rabbits (Gour *et al*., 1995; Reddy *et al*., 2000; Das *et al*., 2002 and Borthakur *et al*., 2003). Igwebuyike *et al*. (1999) found dressing percentage 51.45 to 54.55 per cent when *Acacia albida* pods were added in the diets of growing Dutch rabbits.

Bhatt *et al*. (2000) observed significant differences among the groups when Robinia leaves were a component in rations of SC rabbits and the dressing percentage ranged from 47.65 to 53.55. Rohilla and Bujarbaruah (2001) reported that the dressing percentage both with and without pluck was significantly ($P<0.05$) affected in NZW and SC rabbits under experimental groups fed with *Morus alba* leaves along with concentrate diets. Choudhury, *et al.* (2003) observed that the dressing percentage in SC rabbits were 51.96 percent.Turner *et al*. (1976) reported a higher dressing out percentage in broiler birds when cooked sweet potato was fed to the chicks. Rabbits on diets T_3 and T_4 (dehydrated sweet potato tops and sweet potato roots meal in the ration of 80:20 and 70:30, respectively) recorded the best killing out percent and significantly higher than the control group (Abu *et al*., 1999). Results of the present experiment were in good agreement with the above results since significant differences were observed between dressing percentage of rabbits fed with the control diet (Ration 1) and diets containing d sweet potato (Ration 2, 3, 4 and 5) replacing maize grain 25, 50, 75 and 100 per cent, respectively.

Weight of head and percentage on fasted live weight significantly ($P<0.01$) differed between the breed and rations. The values of percent yield of head was comparable with the values 9.10 to 10.05 for NZW rabbits (Saikia, 1998); 9.72 to 10.94 for Dutch rabbits (Igwebuike *et al*., 1999); 9.82 to 13.96 for crossbred rabbits (Abu *et al*., 1999); 10.20 to 10.68 for NZW rabbits (Kalita *et al*., 2000) and 10.9 for NZW and 10.6 for SC rabbits (Gupta *et al*., 2001). Abu *et al*. (1999) observed a higher value of head weight (%) in T_2 and T_3 group (dehydrated sweet potato tops and sweet potato root meal in the ratio of 90:10 and 80:20 respectively) when sweet potato root meal was fed to the crossbred rabbits. Percent weight of feet and tail did not differ significantly due to breed, ration and ration x breed. Igwebuike *et al*. (1999) reported the tail weight (%) 0.45 to 0.67 and feet 2.04 to 2.84 when *Acacia albida* pods were given in Dutch rabbits and there was significant difference in feet weight. Whereas, Kalita *et al*. (2000) observed 2.78 to 2.94 percent in NZW rabbits and there was no significant difference in feet weight. However, Gupta *et al*. (2001) found a little higher feet weight (%) in NZW (4.0%) and SC (3.9%) rabbits but there was no significant difference among the breed. Rohilla and Bujarbaruah (2000) did not find any significant difference in weight of paws and tail due to incorporation of *Morus alba* leaves in NZW and SC rabbit rations. The values 2.88 to 3.07 per cent reported by the Saikia (1998) for feet and tail were comparable with the present findings and there was no significant difference, which are in agreement with the above workers. The percent blood weight did not differ significantly due to breed, ration and ration × breed (Table 1) and comparable with the values reported by Saikia (1998) and Kalita *et al*. (2000). Rohilla and Bujarbaruha (2000) could not find any significant difference in blood weight when *Morus alba* leaves were incorporated in NZW and SC rabbit feed. The percent pelt weight differed significantly due to ration x breed (Table 1). The values were within the range and comparable with values 9.67 to 10.23 per cent for NZW (Kalita *et al*., 2000), 9.5 for NZW and 9.0 per cent for SC rabbits (Gupta *et al*., 2001), whereas, Igwebuike *et al*. (1999) reported less values (6.55 to 7.75 per cent) in Dutch rabbits.

Abu *et al*. (1999) observed significant differences in fresh pelt weight due to incorporation of sweet potato tuber in the diets of rabbits and the weight (%) was maximum in T_3 and T_4 group where sweet potato root was incorporated in the ratio of 20 and 30 per cent, respectively. Rohilla and Bujarbaruah (2000) also reported significant ($P<0.05$) difference

in pelt weight in NZW and SC rabbits when *Morus alba* leaves were added in the rabbit rations. The present findings are in accordance with the findings of above workers. The percent weight of full stomach and intestine differed significantly due to dietary variations, however, the percent weight of empty stomach and intestine did not differ significantly due to breed, ration and ration x breed. The percent weight of stomach and intestine full and percent of weight stomach and intestine empty was comparable with the recorded values of Saikia (1998). Igwebuike *et al*. (1999) observed 5.66 to 7.68 per cent without content when *Acacia albida* pods fed to the rabbits. However, Rohilla and Bujarbaruah (2000) reported no significant difference in weight of G.I. tract in NZW and SC rabbits when *Morus alba* leaves were added in the rations. Borthakur *et al*. (2003) reported higher values in intestine weight in NZW rabbits at 90 days of age. The percent weight of total inedible offal did not differ significantly due to breed, ration and ration × breed but numerically the value was superior in NZW than SC breed. Saikia (1998) observed the percent yield of total inedible offal 22.38 to 24.69 and Gupta *et al*. (2001) 23.1 in NZW breed and 22.2 in SC breed. Reddy *et al*. (2000) found significantly lower values in SC breed than NZW breed and the values were comparable with the present findings. Rohilla and Bujarbaruah (2000) also reported significant ($P<0.05$) difference in total weight of offal in NZW and SC rabbits fed *Morus alba* leaves along with concentrate mixtures. But, Kalita *et al*. (2000) did not find any significant difference in total inedible offal in NZW rabbits due to various dietary treatments.

The variation in the weight of different inedible offal and their total weight in the present feeding trial might be due to the variation observed in live weight of rabbits at the time of slaughter. Dietary variations significantly influenced the percent yield of heart and liver except percent yield in kidney. There was significant difference among the breed also recorded in respect of heart and liver in percent yield. Abu *et al*. (1999) observed significant differences among liver and kidney weights (%) when sweet potato root was incorporated in the diet of rabbits and also Ahlawat *et al*. (2001) reported significant variations in heart, liver and kidney weight (g) in NZW rabbits when poultry viscera was a constituent of the diets. However, Igwebuike *et al*. (1999) could not find any significant difference in heart and liver weight (%) in Dutch rabbits when *Acacia albida* pods were given in the rations, but there were significant differences in kidney weights. Although the percent weights of heart and liver differed significantly, the weights were within the ranges reported for healthy rabbits of similar ages (MAFF, 1978; Oluokun, 1985; Abu and Ekpenyong, 1993; Igwebuike *et al*., 1995). Therefore, the diets irrespective of the level of sweet potato incorporated feed supported adequate organ development in two breeds of rabbit.

Wholesale Cuts

Except the percent yield of front shanks there were no significant differences in all the traits of wholesale cuts among the breeds (Table 1). Significant variations were observed due to effect of various experimental rations in respect of percent yield of legs, loin, rib and front shanks, whereas, the effect of breed × ration was significant only in legs and rib.

The highest percent weight of legs was recorded in Ration 3 (37.97 ± 0.30) followed by Ration 2 (37.69 ± 0.28), Ration 4 (36.73 ± 0.20), Ration 1 (36.46 ± 0.40) and Ration 5 (35.53 ± 0.35), respectively, whereas in respect of percent weight of loin highest observations were recorded in Ration 1 (28.50 ± 0.21) followed by Ration 5 (28.33 ± 0.17), Ration 4 (28.28 ± 0.08), Ration 2 (27.80 ± 0.15) and Ration 3 (27.58 ± 0.17), respectively. In percent rib weight it was highest in Ration 5 (19.89 ± 0.09) followed by Ration 4 (19.07 ± 0.16), Ration 1 (18.97 ± 0.12), Ration 3 (18.87 ± 0.17) and Ration 2 (18.64 ± 0.21), respectively, whereas in percent weight of front shanks the highest observation was found in Ration 5 (16.24 ± 0.16) followed by Ration 1 (16.05 ± 0.17), Ration 4 (15.91 ± 0.110, Ration 2 (15.86 ± 0.14) and Ration 3

(15.57 ± 0.19), respectively. The SC breed (16.06 ± 0.08) recorded significantly (P<0.05) higher percent of front shanks weight than the NZ breed (15.97 ± 0.12).

The entire whole sale cuts viz. percent weight of legs; loin, rib and front shanks differed significantly due to rations. In percent weight of legs and rib there were significant differences due to breed × ration also (Table 1). The similar trend observed in the weight of hot carcass was followed in wholesale cuts also. The percent yield of different wholesale cuts in rabbits slaughtered at the end of the feeding trial were within the range reported by Mahajan and Sastry (1982), Saikia (1998) and were nearer to the average values reported by Kulkarni *et al*. (1995) in rabbits. Weight of different cuts as per cent of dressed carcass weight was comparable among the groups of rabbits fed rations having 0, 10, 20 and 30 per cent *Leucaena leucocephala* seed (Awosanya *et al*., 1996). Rohilla and Bujarbaruah (2000) reported significant (P<0.05) differences in various physical cuts (shoulder, chest, loin, and legs) in NZW and SC rabbits when *Morus alba* leaves were added in the diets. Abu *et al*. (1999) observed significant differences in thorax and hind legs and the weight were maximum in T_3 and T_4 group where the sweet potato tuber was incorporated at the ratio of 20 and 30 per cent in rabbit rations.

Results of the above parameters indicated that incorporation of sweet potato into the rabbit diets had significant effect on the growth of body parts of rabbits. In respect of higher protein, higher ash and lower fat content in SC breed of rabbit in the present study was in agreement with the findings of Das *et al*. (2002) and also reported the similar observations in SC breed in comparison to NZW breed.

Body Composition

The mean percentage of proximate composition of fresh rabbit meat from different groups slaughtered at the end of the feeding trial have been presented in Table 2.There were highly significant (P<0.01) differences among the breed in respect of moisture, crude protein, crude fat and ash percent of meat. However, due to dietary variations, only moisture content of the meat differed significantly (P<0.05) among all the groups. The groups that consumed sweet potato based rations differed significantly with control group, but there was no significant difference among the groups. The moisture and crude fat percentage were significantly (P<0.01) higher in NZ breed (66.63 ± 0.07 and 3.57 ± 0.06, respectively) than the SC breed (63.43 ± 0.07 and 2.70+0.04, respectively), whereas crude protein and ash percentage were significantly (P<0.01) higher in SC breed (22.56 ± 0.06 and 2.51 ± 0.03, respectively) than the NZ breed (20.70 ± 0.17 and 1.73 ± 0.04, respectively).

Table 2: Major Proximate Composition of *Longissimus Dorsi* Muscle of Rabbit Carcass (Mean ± SE)

Attribute	Ration					Overall (Breed)
	1	2	3	4	5	
I	II	III	IV	V	VI	VII
Moisture Percentage						
NZ	66.667^{ab} ±0.103	66.777^{a} ±0.141	66.360^{b} ±0.028	66.753^{a} ±0.130	66.597^{ab} ±0.229	66.631^{A} ±0.067
SC	63.853^{a} ±0.022	63.407^{bc} ±0.073	63.563^{ac} ±0.143	63.183^{b} ±0.051	63.150^{b} ±0.042	63.431^{B} ±0.075
Overall (Ration)	65.260^{a} ±0.631	65.092^{ab} ±0.757	64.962^{b} ±0.629	64.968^{b} ±0.801	64.873^{b} ±0.777	65.031 ±0.301
Crude Protein Percentage						
NZ	20.337 ±0.142	20.690 ±0.069	20.357 ±0.182	20.773 ±0.023	21.333 ±0.775	20.698^{A} ±0.168

Table 2: Contd.,						
SC	22.637 ±0.009	22.337 ±0.098	22.603 ±0.084	22.783 ±0.018	22.423 ±0.228	22.557^{B} ±0.061
Overall (Ration)	21.487 ±0.518	21.513 ±0.372	21.480 ±0.510	21.778 ±0.450	21.878 ±0.436	21.627 ±0.194
Crude fat percentage						
NZ	3.593 ±0.224	3.630 ±0.046	3.503 ±0.157	3.387 ±0.182	3.730 ±0.053	3.569^{A} ±0.065
SC	2.657 ±0.082	2.583 ±0.210	2.730 ±0.046	2.717 ±0.052	2.813 ±0.042	2.700^{B} ±0.045
Overall (Ration)	3.125 ±0.235	3.107 ±0.253	3.117 ±0.188	3.052 ±0.172	3.272 ±0.207	3.134 ±0.089
Ash Percentage						
NZ	1.840^{a} ±0.056	1.657^{b} ±0.029	1.693^{ab} ±0.117	1.603^{b} ±0.044	1.857^{a} ±0.074	1.730^{A} ±0.038
SC	2.450^{ab} ±0.030	2.387^{a} ±0.090	2.583^{b} ±0.027	2.567^{b} ±0.023	2.557^{ab} ±0.027	2.509^{B} ±0.027
Overall (Ration)	2.145 ±0.139	2.022 ±0.169	2.138 ±0.206	2.085 ±0.217	2.207 ±0.160	2.119 ±0.076

N.B. Sub-class averages with at least one superscripts in common (lower case along the row and upper case along the column) do not differ significantly. * P<0.05, ** P<0.01

The moisture percentage was recorded highest in Ration 1 (65.26 ± 0.63) followed by Ration 2 (65.09 ± 0.76), Ration 4 (64.97 ± 0.80), Ration 3 (64.96 ± 0.63) and Ration 5 (64.87 ± 0.78), respectively. The percentage of moisture, crude protein, crude fat and ash differed significantly (P<0.01) due to breed and the moisture and ash due to breed × ration. The moisture content also differed due to dietary variations. The moisture and crude fat percentage was significantly (P<0.01) higher in NZ breed whereas, the crude protein and as percentage was significantly (P<0.01) higher in SC breed than NZ breed. Due to dietary variations the moisture percent differed with control group (Ration 1) and sweet potato based rations (Ration 2, 3, 4 and 5).

The moisture percent in present experiment was higher than the reported values of Saikia (1998) and Bhatt *et al*. (2000) and lower than Kulkarni *et al*. (1995), Kalita *et al*. (2000) and Das *et al*. (2002). However, the crude protein percent was comparable with the reported values of 19.63 per cent for NZW and 21.52 per cent for SC breed (Kulkarni *et al*., 1995), 19.47 per cent for NZW and 19.67 per cent for SC (Das *et al*., 2002). But, Bhatt *et al*. (2000) reported the crude protein percent in NZW and SC rabbits 20.96 to 23.29 per cent when Robinia leaves were fed to them. The crude fat value in the present experiment were lower than the reported values of Saikia (1998) and Das *et al*. (2002), but higher than the values reported by Kulkarni *et al*. (1995), Bhatt *et al*. (2000) and Kalita *et al*. (2000). The ash content in fresh rabbit meat observed in the present experiment were comparable with Kulkarni *et al*. (1995) but, higher than the values reported by Bhatt *et al*. (2000), Kalita *et al*. (2000) and Das *et al*. (2002).

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